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FACE RECOGNITION WITH LIVE DETECTION AND EXCEL INTEGRATION

[1]Mr. T.. Raghavendra Gupta, [2]Kadali Jagadeesh, [3]Dasari Gopichand,[3],[4]Eemani Mahalakshmi,[5]Beemanaboina Dhanush

[1]Associate Professor, [2]Student, [3]Student,[4]Student,[5]Student

[1]Computer Science & Engineering,

[1]Hyderabad Institute of Technology & Management, Hyderabad, India

Abstract: Face recognition is one of the most useful technologies in Deep Learning which is a part of Machine Learning. The Haar- Cascade method is used to detect and recognize faces from images and videos by considering the features like size and shape of eyes, nose and mouth . The model captures live images , compares them to a database of pre-trained images , and upon a successful match logs the recognized persons details in Excel format . These details include the individual's name, id number , time and date of recognition . The admin has the authority to access these details and keeps track of who's around. So, in simple terms, face recognition systems are like super-smart detectives that help keep things safe by recognizing familiar faces.

Keywords **- Facial Recognition, Live Detection , Haar-Cascade, OpenCV-Python, Deep Learning, Data Management**

1. INTRODUCTION

Currently, face recognition and image processing are fascinating topics that have only just begun to be explored. Facial recognition is fast catching up to other biometric methods (such as RFID and fingerprints) since it uses a unique collection of traits for each individual.

RFID: A wireless system made up of tags and readers is known as radio frequency identification, or RFID. An RFID tag emits radio waves, which the reader's one or more antennas pick up and retransmit. Tags are radio waves that tell readers close by who they are and other information. This technology is used for tracking, inventory management, and validation.

BIOMETRICS : Physical traits or biological measurements that can be used to identify a person are known as biometrics. Biometric technology includes, for instance, fingerprint mapping and retinal scans. However, biometric authentication systems are not perfect. Errors that can lead to fraud include false acceptance and false rejection.

FACE RECOGNITION: In the fields of computer vision and artificial intelligence, face recognition is a cutting-edge technology that allows people to be automatically identified by their facial features. Because of its versatility, it has become increasingly popular and applicable in recent years. The primary goal of face recognition, a state-of-the-art technology at the nexus of computer vision and artificial intelligence (AI), is the automated identification of individuals based on the distinctive qualities of their facial features. Because of this technology's exceptional capabilities and versatility across a wide range of domains, it has seen remarkable advancements and a surge in adoption in recent years.

Face recognition has established a crucial biometric characteristic that is non-intrusive and simple to learn. Systems that rely on facial recognition are not very sensitive to different expressions on the face. Face identification and verification are the two categories that make up a face recognition system. In contrast to

face verification, which compares a face image to a template face image 1:1, face verification compares a query face image to a 1:N problem.

2. LITERATURE SURVEY

The idea of using principal components to represent human faces was developed by Sirovich and Kirby 1987[1] and used by Turk and Pentland 1991[2] for face detection and recognition. It tracks a person's face and then recognizes by comparing characteristics of the face to those of known individuals. Initially, a principal component factor "eigenvector" is determined using PCA then the set of characteristic feature image "eigenfaces" are found.

Paul Viola and Michael Jones in their 2003 article titled, "Robust Real-Time Face Detection": It describes a machine learning approach for visual object detection which is capable of processing images extremely rapidly and achieving high detection rates. It brings together new algorithms and insights to construct a framework for robust and extremely rapid object detection. The simple features used are reminiscent of Haar basis functions which have been used by Papageorgiou et al. Haar-like features are digital image features used in object recognition. In the detection phase of the Viola–Jones object detection framework, a window of the target size is moved over the input image, and for each subsection of the image the Haar-like feature is calculated. This difference is then compared to a learned threshold that separates non-objects from objects. [3]

LBP (Local Binary Pattern) was first described in 1994 and has since been found to be a powerful feature for texture classification. It has further been determined that when LBP is combined with histograms of oriented gradients (HOG) descriptors, it improves the detection performance considerably on some datasets. It is a centralized approach which involves the step by step process. [4]

Automated Attendance Management System Based on Face Recognition Algorithms: This system is based on face detection and recognition algorithms, automatically detects the student when he enters the class room and marks the attendance by recognizing him. [5]

Robust 3D Face Recognition: This paper represents a face recognition system that overcomes the problem of changes in facial expressions in three-dimensional (3D) range images. [6] Monitoring Driver Distraction in Real Time using Computer Vision System: This article presents a real-time non disturbance drowsiness monitoring scheme which exploits the driver's facial appearance to identify and alert tired drivers. This presented work worn the Viola-Jones Algorithm to identify the driver's facial appearance. [7]

Viola Jones algorithm or Haar cascade classifier is a machine learning-based approach for object detection. It uses a cascade function trained on many positive and negative images to classify items in other pictures

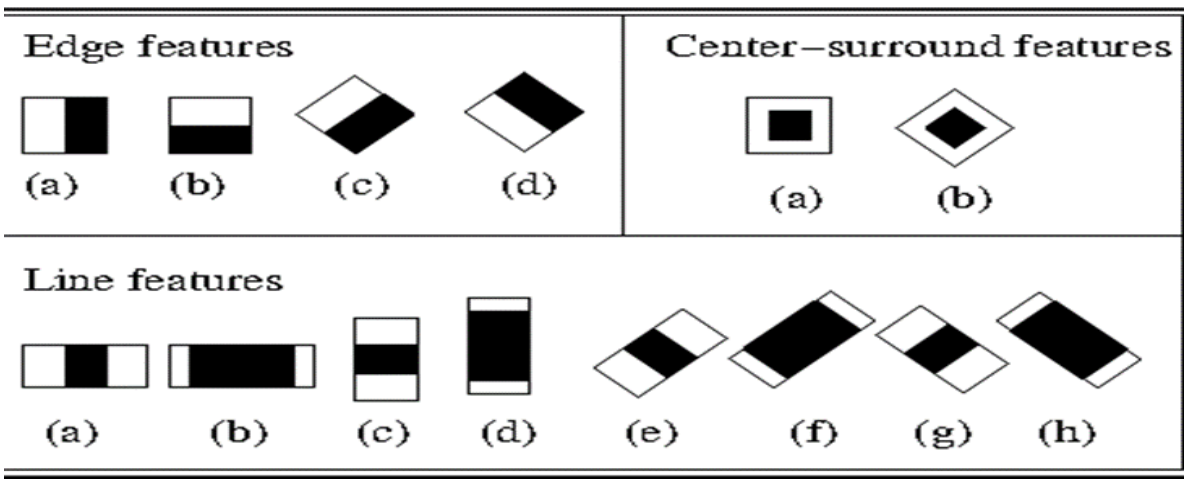

Figure 2.1: Haar Features

Haar features are simple rectangular features which is the difference of the sum of pixels of areas inside the rectangle. This rectangle can be at any position of the frame and can scale the image. This modified feature set is called 2-rectangle feature. Each feature type can indicate the existence or the absence of certain characteristics in the frame, such as edges or changes in texture[8]

Structure of Face Recognition System Every Biometric system has four main features which are shown in Figure.2: Face Detection, preprocessing, Feature Extraction, and Face Recognition.

Figure 2.2: Architecture of Face Recognition System

Architecture of Face Recognition System As Figure 2 shows the first task of the face recognition system is capturing image by video, camera or from the database and this image is given to the further step of face recognition system i.e to preprocess step for removing unwanted noise and blur ,then to feature extraction and at last to Face Recognition for verification /identification [9]

Facial Feature Extraction :The importance of facial features for face recognition cannot be overstated. Many face recognition systems need facial features in addition to the holistic face, as suggested by studies in psychology. It is well known that even holistic matching methods, for example, eigenfaces proposed by Turk and Pentland and Fisher faces, which proposed by Belhumeur, need accurate locations of key facial features such as eyes, nose, and mouth to normalize the detected face. Features provide more accurate and consistent representation for alignment purposes than region based features, with lower complexity and computational burden than contour feature extraction. Three types of feature extraction methods can be distinguished: (1) generic methods based on edges, lines, and curves; (2) feature template-based methods that are used to detect facial features such as eyes; (3) structural matching methods that take into consideration geometrical constraints on the features.[10]

3. PROPOSED SYSTEM

Proposed system includes training the model with labeled data and testing it with a live camera and collecting the data in excel format. These steps are accomplished by using Python ,Face Recognition and required libraries like OS, date-time, numpy, & CSV.

The basic outline working of the model is as follows:

1. Face detection: The system uses a pre-trained Haar cascade classifier to detect faces in an image or video stream.
2. Pre-processing: The detected faces are then pre-processed to improve the accuracy of the recognition process. This may involve steps such as grayscale conversion, noise reduction, and histogram equalization.
3. Feature extraction: A set of facial features is extracted from each pre-processed face. These features may include the distance between the eyes, the length of the nose, and the shape of the lips.
4. Classification: The extracted features are then classified using a machine learning algorithm to identify the person.

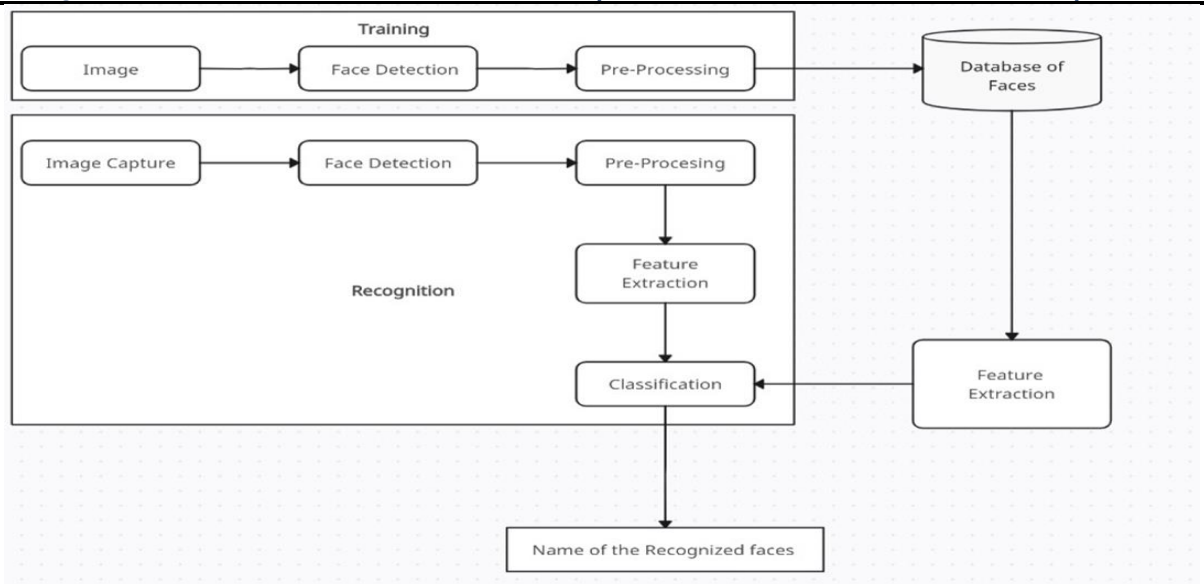

Figure 3.1: Model Architecture

Figure : System Architecture shows the complete working of the model . Model is mainly divided into 2 phases namely training and recognition phase.

Training Phase:

In the training phase we train the model with a dataset consisting of labeled images by using a supervised learning approach.
This phase has 3 steps: Loading dataset of images ,face detection and pre-processing.

Loading the Dataset of images:
The model is given with a dataset consisting of labeled images of faces and without faces.

Face detection:

- Apply a Haar cascade classifier to the input image to detect faces.
- For each detected face, extract the bounding box coordinates.

Pre-processing:

- For each face bounding box:
  - Convert the image to grayscale.
  - Apply noise reduction techniques to reduce noise and improve image quality.
  - Perform histogram equalization to normalize the distribution of pixel intensities.

Database of Images:

After the pre-processing the images are stored in the form of a 3D matrix of RGB.
To these pre-processed images the Feature Extraction process is applied.

Feature extraction:

- For each pre-processed face image:
  - Extract a set of facial features that represent the unique characteristics of the face.
  - Common facial features include:
    - Distance between the eyes
    - Length of the nose
    - Shape of the lips
    - Position of the eyebrows
    - Texture of the skin

Recognition Phase:

In the Recognition phase the model is given with a test image i.e live image to identify the people.

Step by step working of model in the recognition phase is as follows:

1. Capturing an image from an image or from a video stream with the help of a camera.
2. Using Haar cascade classifier to detect faces in the captured image or video stream.
3. Pre-processing the detected faces to improve the accuracy of the recognition process. This may involve steps such as grayscale conversion, noise reduction, and histogram equalization.
4. Extracting a set of facial features from each pre-processed face. These features may include the distance between the eyes, the length of the nose, and the shape of the lips.
5. Classifying the extracted features using a machine learning algorithm to identify the person.During the classification process model uses the existing set of features for comparison.
6. Recognized person's name is displayed on screen to the user and all the recognized people's data is stored in an Excel sheet.

4. RESULTS & DISCUSSION

When the model is given with the test image ie. image detected from video capture, the process of face recognition will happen.The image is detected then it is pre -processed and features are extracted,and at last the recognition process will happen with the help of these extracted features. If the features are matched with trained data then the person is said to be recognized and the person's name is displayed on screen and all the details of the person are logged to Excel Sheet.

Figure 4.1 if match not found

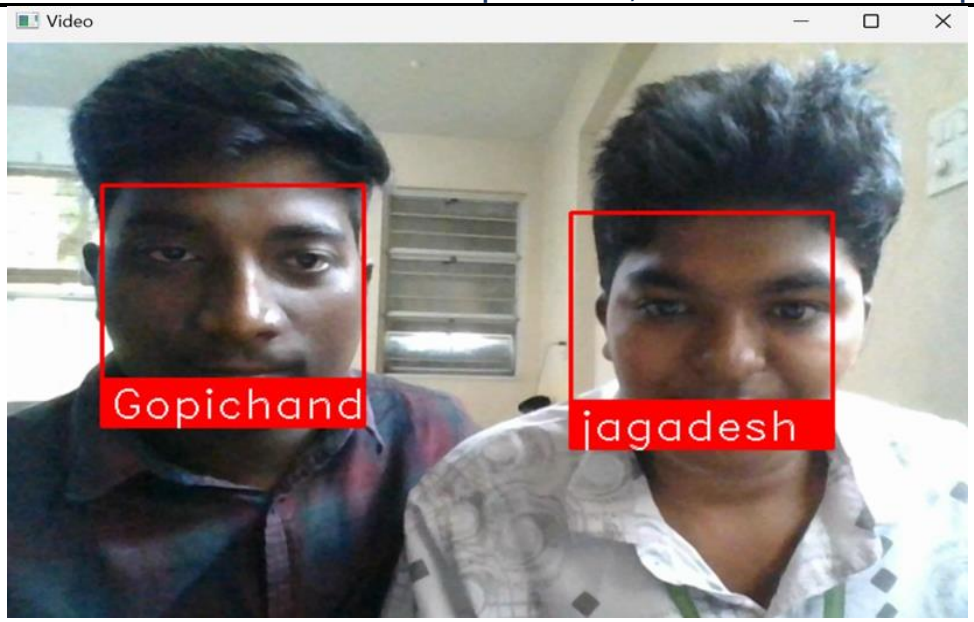

Figure 4.2 if match found

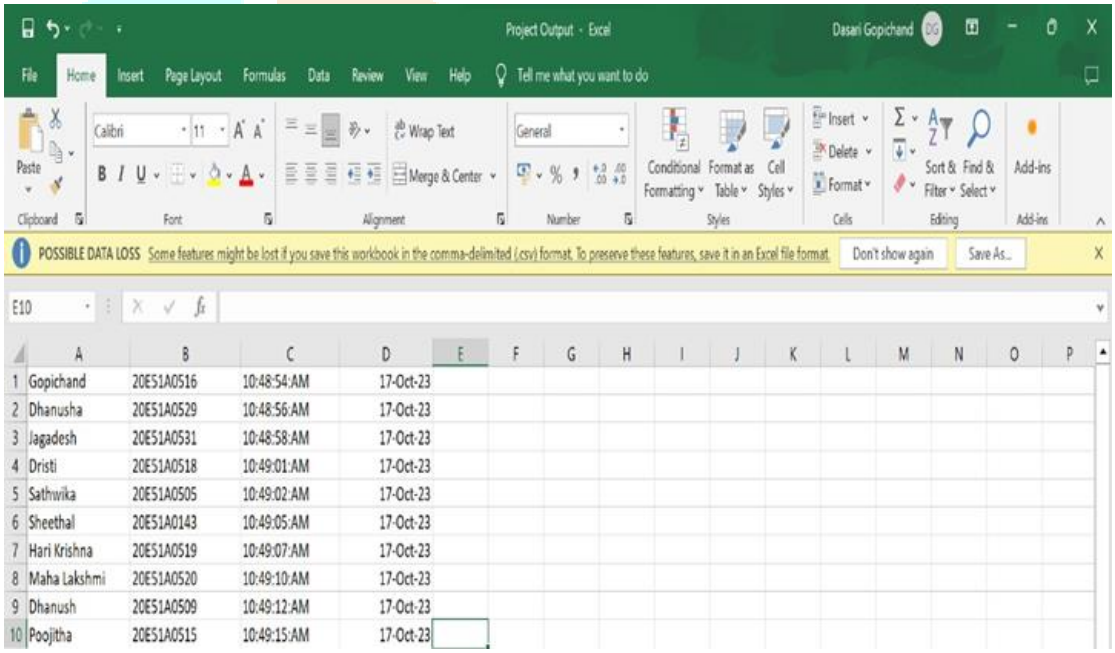

Figure 4.3: Excel Integrated Output

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